

NOAA SECTORAL APPLICATIONS RESEARCH PROGRAM (SARP)

PROJECT ANNUAL REPORT

PROJECT TITLE

Water Transitions: Helping the Formal and Informal Urban Water Sectors in Developing Country Cities Adapt to Climate Change

INVESTIGATORS

(Research team and full contact information)

Lead Principal Investigators:

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PROJECT YEARS

TIME PERIOD ADDRESSED BY REPORT *(e.g., August 2002-March 2003)*

July 2008 – March 2009

I. PRELIMINARY MATERIALS

A Project Abstract *(Limit to one page)*

Water resource managers in developing country cities face complex challenges including the lack of infrastructure and adequate management mechanisms to provide for the needs of populations, the web of different water sources accessed by residents, and multifaceted relationships with the informal water sector. Climatic variability adds a new dimension to these challenges, and requires a new set of tools to help water resource managers understand the potential impacts of climate change and create some planning strategies to provide resilience in the face of change.

The project will involve collaboration between two of the leading international NGOs working on the science and policy of climate, water resources, management, and adaptation: the Pacific Institute and the Institute for Social and Environmental Transition (ISET), working together with local partners in South and Southeast Asia. The goal of this project is to develop a framework as well as a few key tools to guide water resource managers in the formal sector in understanding the potential impacts of climate and social change on water resources and in developing a process to address these impacts. Through detailed dialogues in an urban area in India, and potentially one in Southeast Asia, we will bring together water stakeholders including water managers, NGOs, and the private sector to identify key needs that water stakeholders have in responding to climate change.

Due to decaying infrastructure, lack of funds, and a variety of other problems, the formal water sector is only able to provide sporadic service to many urban dwellers. Migrant populations and informal settlements in peri-urban areas are not served by the formal water sector. As a result, most urban dwellers rely on the informal water sector to supplement or completely fulfill their water needs. Furthermore, the potential impacts of climate change on the water supply and demand cycle rarely enter into the planning and management strategies of the formal sector. The informal water sectors do not even consider climate change and often lack the economic capability to engage in long-term strategies. The dynamics of economic and natural resource migration, with some migrating only on a short-term basis, coupled with the impacts of climate change and social change on water resources, have the potential to completely overwhelm formal urban water sectors in India. This situation is not unique to India, however, and is descriptive of the situations that face many developing country water managers.

We will research the practical adaptation strategies that urban water managers in South Asian cities can make that complement the autonomous adaptation strategies undertaken in the informal sectors and are resilient to a wide variety of unknown climate effects and social change. The research will help guide the development of a framework of action, consisting of a suite of resiliency tools that enable the formal urban water sector to flexibly respond to a variety of uncertain climate and socio-economic scenarios. The flexibility and resiliency of the tools developed from this project will be designed for applicability in other developing country contexts.

Dr. Moench and Dr. Gleick, the lead investigators, have combined expertise in hydrogeology and hydroclimatology, institutional economics, climate change policy and adaptive strategy. Dr. Gleick was the lead author of the U.S. National Assessment of the effects of climate change on water resources and has spent 20 years working on climate impacts and how water managers can understand and address these impacts. Meena Palaniappan is a water and waste water engineer by training with extensive experience in community environmental planning and developing country urban water issues. Over the course of the last 15 years, Ms. Palaniappan has worked with NGOs in Tamil Nadu on sanitation and water issues. The Action Plan for Clean Waterways in Chennai that she helped develop was endorsed by the Tamil Nadu Government. Dr. Moench has collaborated with local partners on climate change adaptation strategies and disaster risk reduction strategies in the states of Bihar, Uttar Pradesh, Gujarat and Tamilnadu. He also led the groundwater component of the India Water Sector Review for the Government of India and the World Bank.

B Objective of Research Project (*Limit to one paragraph*)

This project will develop a set of tools to help water managers assess their water system for resilience to climatic and social variability, identify and evaluate potential adaptation strategies, and create a process to deal with climatic and social change. Developing frameworks to enable communication between the formal and informal water sectors is an important aspect of this project. We will work at both the formal and informal sectoral level in order to identify strategies vital for both. The outcome of this project will be a broad framework within which water managers can operate as well as a set of key tools. We will not seek to create specific models or analytical packages to guide water managers from specific climatic predictions to a predetermined set of mitigation strategies. When we use the term “tools,” we mean processes for evaluating climate impacts and identifying mitigation options, successful frameworks for organizing information, and effective approaches to evaluate the resiliency of different adaptation strategies.

C. Approach (including methodological framework, models used, theory developed and tested, project monitoring and evaluation criteria) include a description of the key beneficiaries of the anticipated findings of this project (e.g., decision makers in a particular sector/level of government, researchers, private sector, science and resource management agencies) (*Limit to one page*)

Phase I: Reviewing Climate, Water Resources and Social Change Information

In the first phase, we will conduct a review of literature and existing tools for water managers to assess and adapt to climatic variability in both short-term and long-term planning through web-based research and interviews with key international and regional stakeholders. We will evaluate the current resources available to water managers and identify their strengths, weaknesses and key gaps.

Phase II: Shared Learning Dialogues at multiple levels

In the second phase, we will conduct shared learning dialogues: structured meetings with groups of key actors at regular intervals throughout the research project that allow for instant feedback between actors and the researchers in order to facilitate knowledge generation, testing, dissemination and application. These will be conducted in Indore, India, chosen partly in coordination with the Rockefeller Climate Initiative. At the same time, we will survey international and regional associations of water managers, including the International Water Association, to solicit feedback, ideas, and toolset needs. This will allow us to identify the priorities of water stakeholders in the metropolitan region and solicit feedback from the associations of urban water managers.

Phase III: Developing the Decision-Support Tools

In the third phase, we will iteratively conduct research and produce decision-support tools for water managers in the developing country context. Based on the results of the shared learning dialogues, we will identify 2-3 key decision-support tools that will be developed, including an overall framework paper. A comprehensive, yet flexible set of tools for developing country water managers to move toward resiliency in the face of climate and social change will address the following goals: (a) accessing and understanding climate change information and water resources impacts for a given region; (b) assessing the viability of current and future supplies of water; (c) assessing the nature of increasing demand due to migration and population growth; (d) evaluating the roles of the informal sectors and developing strategies to engage and incorporate the informal sector into future planning; (e) assessing the potential for demand management; (f) identifying potential adaptation strategies; and (g) evaluating these adaptation strategies.

Phase IV: Disseminating the Tools and Planning Pilot Implementation

The fourth phase of the project will be focused on publishing and disseminating the framework and decision-support tools that are created for a wide range of developing country water managers, their technical and financial supporters, and the local and international NGO community. Through re-convenings of the shared learning dialogues in Indore, we will introduce the decision-support tool. The project team and key members of the steering committee will also seek funding to present results at international meetings and conferences where potential users of the tools may be participating.

A primary goal of the work will be to further develop more modules toward a comprehensive, flexible decision-support tool. We will use this initial model to educate funding partners on the

potential and need for a comprehensive, flexible toolkit among water sector managers that can enhance the resiliency of urban water systems in dynamic climate and social processes. Another important goal is to see elements of the decision-support tool be used and implemented by water managers in one or two developing country cities with technical support from the project team. We will be seeking ongoing project support from other funders to help us extend the reach of this model and conduct implementation.

D. Description of any matching funds/activities used in this project (*Limit to one paragraph*)

This project is implemented in close synergy with the *Asia Cities Climate Change Resilience Network* (ACCCRN) project supported by The Rockefeller Foundation. The ACCCRN activities on assessing vulnerability to Climate Change and identifying adaptation options span across cities from four countries in South and South-East Asia: India, Indonesia, Thailand and Vietnam. In India, the project focuses on three cities—Indore (common to NOAA project), Surat and Gorakhpur. Shared Learning Dialogues are a core methodology element on both the projects. Specifically, the SLDs help to understand perceptions and build views on vulnerability issues across sectors including the water sector (ACCCRN project) and an array of tools (NOAA project) that can aid urban water managers in the climate change context. In conjunction with SLDs, city-wide field surveys are planned under the ACCCRN project through questionnaires/ checklists at household and community/ ward levels. By design, the questionnaires cover issues relevant to both projects. The project team involved in research design, analysis and execution of the ACCCRN project is the same involved in the NOAA project. Additionally, the outputs of both projects are designed to feed into each other: a) the analysis of surveys from the ACCCRN project will provide key input into the design of tools for the NOAA project; and b) the tools developed under the NOAA project, with some modification, will be used in the ACCCRN projects cities - in India as well as other countries.

II. ACCOMPLISHMENTS

- A. Brief discussion of project timeline and tasks accomplished. Include a discussion of data collected, models developed or augmented, fieldwork undertaken, or analysis and/or evaluation undertaken, workshops held, training or other capacity building activities implemented. (*This can be submitted in bullet form – limit to two pages*)

PHASE I

August 2008 to January 2009: comprehensive review of existing tools in climate change and water – identified key gaps, including the failure to address the particular needs of utilities and communities in developing countries. Results are presented in the attached excel spreadsheet.

PHASE II

October 2008 to March 2009: Indore in the central Gangetic Plain in the Indian state of Madhya Pradesh selected for the shared learning dialogues (SLDs). Two intensive field visits to Indore for SLDs, focused group discussions (FSDs) with various stakeholders, and over a dozen project team meetings.

Developed three questionnaires/checklists for water managers that formed the basis of discussions for meetings and group discussions. Also collected primary and secondary data,

which will be corroborated through ongoing surveys planned in each community. Contracted TARU as our local partner.

First visit to Indore by the project team to understand the complex water supply and management issues in Indore:

- Discussions with TARU about the water supply in Indore and contacts established so far with both formal and informal water managers. Discussions on ways to move forward by conducting one-to-one meetings on water supply and management in the city.
- Meeting with the President of the Lokmanaya Tilak society and President of Self-Help-Group (SHG). The SHG focuses on solid waste management, rainwater harvesting, and water conservation and recharging methods.
- Meeting with Janvikas, a church based organization that works on employment of women, children's education and vocational training mostly in slum areas. Key problems in the slum: unavailability of clean drinking water, lack of access to clean sanitation, issues related to financing and micro-credit.
- Meeting with the Project Manager of the "City Water Supply and Environment Improvement Project" (official name for the Narmada Phase III project) on the various phases of the Narmada Project, progress made so far under Phase III, the institutional landscape of water supply in Indore and jurisdictional issues that affect the project.
- Meeting with NGO Uttkarsh that focuses on education of slum children. Key concerns identified: groundwater depletion and pollution and minimal recharge.

Second field visit: one-to-one meetings and FGDs based on questions formulated for water managers to identify key tools to help water managers. The main selection criterion in the informal sector was the source of water supply and socio-economic status:

Formal water sector: Indore Municipal Corporation (IMC): Discussions on the institutional landscape of the Narmada water supply and management to the city.

Informal water sector:

Scheme No 114: community dependent on individual bore wells and private tankers; water availability and water pollution biggest concerns; procedural delays between Indore Development Authority and IMC one of the major obstacles in providing Narmada pipe water to the scheme; no information so far with community on Narmada III phase and whether they will get water from this.

Goyel Vihar: community sets unique example for community-managed bore wells and conservation; optimal use of Narmada water supply also helps them in meeting their water demands.

ShantiNagar Slum: most affected due to lack of access to water supply, poverty exacerbates the existing deplorable water situation; women and children most affected by the highly erratic water supply.

Nayapura Central: community receives water supply from a chamber constructed on main Narmada pipe line; irregular water supply; hydro-geopolitics coupled with politics of religious differentiation marks the water scarcity and mismanagement in the locality.

Private water tankers, Niranjanpur: supplies water to about 50-60% of the city; power politics affects their business.

Centre for Environment Protection, Research and Development (CEPRD): main reasons for water scarcity: unequal social distribution of water, water theft, poor maintenance of water pipes; alternatives offered: zonal planning, reasonable tariff structure.

Mr. Sandeep Narulker GSITS College: faulty distribution and poor management main reasons for water scarcity; alternatives for better management of water: re-cycling water plant in the college.

Mr. Nikhal Kothari: builder: water supply for construction mainly from individual bore wells; inclusion of rainwater harvesting recharge pits in newly constructed residential complexes now being promoted in new construction.

Mr. Deepak Sharma: architect: norms exist for water harvesting in buildings but no policy in place; need better coordination between different government agencies (IMC and IDA).

Mr. Anil Kaushal: Water harvesting is a good alternative to help replenish bore wells.

Mr Virender S.Chouhan: builder: construction work is put on halt during peak summers.

Analysis: responses generated enabled a better understanding of the complex water management system, highlighted contested notions of water supply and management between formal and informal water managers, and highlighted examples of better community based water conservation and management practices. All this helped in collating the set of tools that each water manger identified in order to better manage their services. Outcomes will provide a platform for conducting SLDs between the key water mangers and for further refining tools for water mangers for Indore.

B. Summary of findings, including their potential or actual implications for efforts to develop applications, methods, and science-based decision support capacity/systems and to foster sustainable resource management and vulnerability reduction. (*Limit to two pages*)

Activities undertaken so far have enabled the team to broadly identify and rank, on a scale of 1-5 where 5 is most severe, the major concerns that each of the water mangers identified and to also highlight key responses from formal and informal water mangers on transparency/ information/ decision-making/ connectivity tools needed for better water management. Outlined below is a summary of major concerns and tools.

Formal Water managers: For the formal water managers who come from a state-centric paradigm of understanding water supply and demand, water scarcity is largely understood in terms of techno-engineering. Shortage in supply and burgeoning population are cited as root causes of water scarcity. Current water supply is largely met through Narmada (nearly 80%) and through 42 tankers of IMC. For effective monitoring of the water supply system, Nigam Parshads (Ward Members) link the people and the IMC. Narmada Phase III, according to officials, will not only fill in the present gap between supply and demand but is expected to meet the demands of the 40,000,000 population estimate for 2023. For improved water conservation, the IMC is planning to make water conservation mandatory at all levels and to formulate a policy in this regard soon.

Informal Water managers:

1. **Communities:** Scheme No 114: all four communities share common concerns: water availability is ranked 5 (most severe), water quality ranked 4, cost of water is ranked 3. Common responses on tools they need to better manage water are:
 1. Information on water-recharging techniques and support from government and other agencies
 2. Common boring needs to be propagated by the IMC
 3. Total ban on direct water motors to check the misuse and theft of water

4. IMC should help set up infrastructure required for recharging of the grey water, and generate more awareness on how to better manage water
 5. Water recharging must be made mandatory IMC, and IMC should make provisions to monitor the recharging process
 6. Some houses have installed rainwater harvesting, but they need support from the IMC to help set up the infrastructure
 7. Information on Narmada Phase III and how the supply will enhance their current water usage
 8. Construction of overhead tanks in Nayapura community
 9. Regular Narmada water supply and improvement in present water supply
 10. Information on how to maintain water quality and inexpensive methods available
 11. Information on best water conservation and management practices
 12. Use of media for information dissemination with NGO support for all mentioned needs
 13. Information on artificial recharging
 14. More awareness generation on how to better manage water
2. **Private water tankers, Niranjanpur village:** Niranjanpur is a rural area within the IMC's jurisdiction. Approximately 50%-60% of Indore's water demand is fulfilled by private tankers from this village. According to the tanker owners, there will be no impact from the Narmada project as demand is increasing every day while the dropping groundwater level will affect their business. The biggest threat perceived by the private tankers is from the IMC which is trying to take control of their hydrants.
3. **CEPRD and GSITS College:** Main reason for water scarcity is unequal social distribution of water; poor and faulty water management; water theft and loss. Important alternatives that can improve transparency, connectivity for better water management are: reasonable tariff structure; proper distribution system; zonal planning; need for good statistical data which needs to be verified; comprehensive integrated planning by an agency; good networking between the departments responsible for water supply and management; systematic study of future demand; regular demand-supply audits; a transparent public address system.
4. **Builders and Contractors:** better communication among large builders about new practices of water and energy conservation; need for a policy on water harvesting in buildings; awareness generation among the general public and large builders/ architects on best water conservation and management practices; coordination between IDA, TCPO and IMC for proper development of the city.

C. List of any reports, papers, publications or presentations arising from this project; please send any reprints of journal articles as they appear in the literature. Indicate whether a paper is formally reviewed and published. *(No text limit)*

UN Habitat and WaterAid National Workshop on Water and Sanitation Services for the Urban Poor: Bhopal, India, March 5 - 7 2009. Meena Palaniappan (Principal Investigator,

Pacific Institute) and Shashikant Chopde (ISET Research Associate) presented this project to a group of NGOs, government agencies, elected officials and community members and discussed the role of climate change in water supply and availability, and the work to identify and develop tools needed to improve water management.

5th World Water Forum: Istanbul, Turkey, March 16-March 22. Meena Palaniappan (Principal Investigator, Pacific Institute) made two presentations in Theme 1 on Climate Change and Water. In Session 1.1 on Local Actions in Climate Adaptation, Ms. Palaniappan gave a presentation on the need to consider developing countries as hotspots given the coping needs and the complex water networks in existence in these countries. In Session 1.1 Roundtable 3, Ms. Palaniappan presented a detailed case study of Indore and the particular challenges of addressing climate change adaptation in the context of a decentralized water system that involves many different actors.

Presentations are attached here in PowerPoint.

D. Discussion of any significant deviations from proposed workplan (e.g., shift in priorities following consultation with program manager, delayed fieldwork due to late arrival of funds, obstacles encountered during the course of the project that have impacted outcome delivery).

(Limit to one paragraph)

A key change has been the focus on communities as a locus of action. Because of the complex network of stakeholders and water managers in the Indian context, considering the formal water sector, or the water utility, as the primary locus of change is not an effective strategy. Also, formal water managers or water utilities will only use a new tool if it is required of them through national or state legislation or regulation. Because of this bureaucratic hurdle, we decided that creating a tool for formal water managers that may end up unused was not an effective use of funds or the potential of this project. Thus, we are now focusing on creating tools for another important water manager, individual households, and communities.

E. Where appropriate, describe the climate information products and forecasts considered in your project (both NOAA and non-NOAA); identify any specific feedback on the NOAA products that might be helpful for improvement. (bulleted response)

1) Global Historical Climate Network (GHCN) monthly and daily datasets. The user interface to these datasets could be improved, using a similar access and format as the data access through the PSD (Earth System Research Laboratory: Physical Sciences Division) Interactive Data, Plotting and Analysis Pages.

2) Multiple products through the PSD (www.cdc.noaa.gov) website, particularly the NCEP/Reanalysis project data.

Non-NOAA products are a large group, so only few key products are listed here:

- 1) Data from the Canadian Centre for Climate Modelling and Analysis
- 2) Data from the WCRP CMIP3 Multi-Model Dataset Archive at PCMDI
- 3) Tyndall Centre CRU TS 2.1
- 4) Data from the European Centre for Medium-Range Weather Forecasts (ECMWF)

III. GRAPHICS: PLEASE INCLUDE THE FOLLOWING GRAPHICS AS ATTACHMENTS TO YOUR REPORT

- A. One Power point slide depicting the overall project framework/approach/results to date
- B. If appropriate, additional graphic(s) or presentation(s) depicting any key research results thus far
- C. Photographs (if easy to obtain) from fieldwork to depict study information (if applicable).

IV. WEBSITE ADDRESS FOR FURTHER INFORMATION (IF APPLICABLE)

www.pacinst.org; www.i-s-e-t.org

V. ADDITIONAL RELEVANT INFORMATION NOT COVERED UNDER THE ABOVE CATEGORIES.

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